

9. A COLLECTION OF CHIGGERS FROM GUNONG BENOM
(PROSTIGMATA: TROMBICULIDAE)

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9. A COLLECTION OF CHIGGERS FROM GUNONG BENOM
(PROSTIGMATA : TROMBICULIDAE)

By M. NADCHATRAM

THIS report summarizes the trombiculid mites collected on Gunong Benom from 17 February through 8 April 1967. Topography and vegetation are described by Medway (1972a) and Whitmore (1972), and the taxonomy and distribution of hosts by Grandison (1972), Hill (1972) and Medway (1972b).

Although the Institute for Medical Research in the past has made intensive as well as extensive collections of trombiculid mites as part of an investigation of the epidemiology of scrub typhus, this is the first time that these and other ectoparasites have been collected on Gunong Benom. The knowledge of the mite fauna of this isolated mountain adds to the information being gathered for zoogeographical and ecological studies. Furthermore, it will enhance our understanding of the ecological relationships of scrub typhus vectors to topography and vegetation.

Mites of the family Trombiculidae (sub-class Acari) are parasitic only in the larval stage (when they are known as chiggers), yet they are amongst the most abundant, both in numbers and species, of all ectoparasites of mammals. They are soft-bodied and range from 0.2 to 2 mm in length. The post-larval stages, i.e. the nymph and adult, are non-parasitic.

The colour of chiggers ranges from white or yellow to light orange or red. Chiggers are essentially habitat-specific, and their colour is to a great extent dependent on their biotope. They may be separated into two broad ecological groups—ground-surface dwellers and nidicolous species. Ground-surface dwellers include the scrub-itch mites and the vectors of scrub typhus, and are coloured orange to red. Nidicolous species, with a few exceptions, are white to yellow, and represent almost 83 per cent of the 146 species of chiggers known in Malaya. Of these 70 to 80 per cent are cavernicolous in habitat, i.e. live in the ground-burrows of small mammals. Nadchatram (1970) has proposed seven ecological groups for the species of chiggers known in Malaya (Ecological Groups I to VII) on the basis of (a) the colour of the chigger prior to attachment to a host, (b) association of the chiggers with habitat and (c) their association with the favoured hosts. Under each species reported below the appropriate ecological group number is given.

The chiggers of medical importance in Malaya known thus far are of two categories. Those that transmit the agent of scrub typhus are *Leptotrombidium akamushi* (Brumpt) mostly found in grassland, *L. deliense* (Walch) mostly found in plantations, forest and the forest fringe and, probably, *L. arenicola* Traub restricted to seacoast

vegetation. The other category of chiggers causes dermatitis in man. They are *Eutrombicula wichmanni* (Oudemans), *Blankaartia acuscutellaris* (Walch), and *Schoengastia psorakari* Nadchatram and Gentry.

Out of 177 examined, 87 reptiles, birds and mammals were infested with chiggers. Over 3,000 chigger specimens from animal hosts and from ground-holes were collected, representing 35 species in 14 genera. *L. deliense* was found only in small numbers, but a very closely related species, *L. bodense* (Gunther), was abundant. No other of the medically important species listed above were found, although the genus *Leptotrombidium*, which is the important genus from the viewpoint of epidemiology of scrub typhus, is represented by 5 species. The collection yielded a new species of *Myotrombicula* from *Rhinolophus stheno* (Nadchatram and Lakshmy 1969), and a new record of chiggers for Malaya, *Neoschoengastia solitus* Nadchatram, from *Pitta sordida*.

The infestation data is presented in three parts. The first is a list of chiggers found in Gunong Benom with relevant notes on host and habitat distribution. The second part is a list of the infested animals and the species of chiggers found on them, and the third a list of unattached chiggers found in holes.

OBSERVATIONS

I. Chiggers found on Benom

Audyana thompsoni Womersley, 1954

14 ex 1 *Heterometrus longimanus*, 750 ft. This larval species is not a trombiculid, but belongs to a closely allied family, Trombidiidae; it is often found together with a trombiculid species, *Eltonella eltoni*. Colour pallid. Ecological Group VII.

Odontacarus audyi (Radford, 1946)

Two specimens collected, with *Toritrombidula densipiliata*, from *Pitta caerulea*, 800 ft. Orange chiggers parasitic exclusively on birds and widely distributed in Southeast Asia. Indications are that this species is a ground-surface dweller. Ecological Group I.

Eltonella tweediei Audy, 1956

29 specimens ex 8 *Draco* spp., 750 to 800 ft. Because of concurrent habitat-specificity of host and parasite, this species has never been found on other animals. Often found with *Neoschoengastia riversi*. An arboreal species, bright orange to red. Ecological Group III.

Siseca rara (Walch, 1923)

One ex *Pitta sordida*, 900 ft and 2 ex 1 *Callosciurus caniceps*, 900 ft. This is a common species found on reptiles, birds and mammals, including man (in Sumatra). Unfed larvae were recovered from ground-surface and nests of squirrels. Orange to red. Ecological Groups I and III.

Leptotrombidium bodense (Gunther, 1940)

A very common species in Malayan forests, it is represented in the Gunong Benom collection as follows: 6 ex 1 *Napothera macrodactyla*, 700 ft; 3 ex 1 *Echino-sorex gymnurus*, 700 ft; 24 ex 6 *Rattus sabanus*, 700 to 1000 ft; 8 ex 1 *R. muelleri*, 800 ft; 36 ex 1 *R. bowersi*, 800 ft; 6 ex 1 *R. cremoriventer*, 800 ft; 124 ex 4 *R. edwardsi*, 3500 to 4000 ft. Unfed larvae of *L. bodense* have been found on ground-surface and in ground-burrows. Ground-surface chiggers are orange and hole chiggers pallid. Nadchatram & Upham (1966) synonymized *L. langati* Audy & Womersley with *L. bodense*. Ecological Groups I and II.

Leptotrombidium deliense (Walch, 1922)

A well-known vector of scrub typhus, this species is poorly represented in the Gunong Benom collection, as follows: 1 ex 1 *Pitta sordida*, 900 ft; 1 ex 1 *R. sabanus*, 800 ft; 16 ex 1 *R. muelleri*, 800 ft; 13 ex 3 *R. edwardsi*, 3600 to 4000 ft. This species, however, is common in plantations and the forest fringe. It has been recorded frequently from ground-surface, ground-burrows, and occasionally in nests of rats and squirrels on trees. It is believed that *L. deliense* evolved from mites of a sylvatic origin and a cavernicolous habitat. Like *L. bodense*, hole chiggers are pallid and ground-surface dwellers orange. Ecological Groups I and II.

Leptotrombidium gentryi Nadchatram & Upham, 1966

This species was first described from unfed larvae collected in ground-holes. The Gunong Benom collection includes 2 specimens collected on a 'bakelite' plate in two separate ground-burrows in a bank alongside a disused logging track, 2½ ft above the ground, at 1000 ft. The host is still unknown. Pallid. Ecological Group II.

Leptotrombidium kundini Nadchatram & Upham, 1966

This species was also taken by plate collections. 13 specimens found in 4 ground-burrows in the bank of the logging track at 1000 to 1200 ft. A pallid species, in Ecological Group II.

Leptotrombidium sylvestre (Audy & Traub, 1950)

39 specimens ex 3 *R. edwardsi*, 3500 to 4000 ft. This is also an uncommon sylvatic species and appears to be associated more with *R. edwardsi* than other rodent hosts. This collection further confirms that *L. sylvestre* is a denizen of montane and sub-montane forests. Pallid chiggers in Ecological Group II.

Toritrombicula densipiliata (Walch, 1922)

12 ex 1 *Pitta caerulea*, 800 ft; 1 ex *Pitta sordida*, 900 ft; and 3 ex 1 *Philentoma velata*, 1800 ft. This species is restricted to birds and widely distributed throughout Southeast Asia, possibly as a result of the migratory habit of some of its hosts (including *P. sordida*). Orange chiggers in Ecological Group I.

Myotrombicula medwayi Nadchatram & Lakshumy, 1969

Gunong Benom is the type locality for this species. A single specimen ex *Rhinolophus stheno*, 700 ft. It is only the second species of the genus known in Malaya. Orange chiggers in Ecological Group V.

Chiroptella sandoshami Nadchatram, 1966

23 ex 15 *Rhinolophus stheno*, 700 to 3600 ft; one ex *R. affinis*, 2500 ft; 2 ex 1 *R. macrotis*, 750 ft. The 24 species of chiggers known from bats in Malaya are apparently exclusive to these mammals. Whether species of chiggers are specific to any species or genus of bats is not yet clear. *C. sandoshami* is a common parasite of *Rhinolophus*, but the apparent host-specificity may be due to ecological factors. Yellow chiggers in Ecological Group V.

Neoschoengastia riversi Wharton & Hardcastle, 1946

18 ex 1 *Draco* sp., 800 ft. Members of the genus *Neoschoengastia* are mostly parasites of birds. In Malaya, however, *N. riversi* is frequently found on flying lizards, although the type host of the species is a bird. Orange chiggers in Ecological Group III.

Neoschoengastia solitus Nadchatram, 1967

4 ex 1 *P. sordida*, 900 ft. This is the first record of its occurrence in Malaya. The host is a migratory bird*. Orange chiggers in Ecological Group IV.

Walchiella impar (Gunther, 1939)

50 ex 1 *Echinosorex gymmurus*, 700 ft; 16 ex 1 *Tupaia minor*, 700 ft; 20 ex 1 *Ptilocercus lowii*, 1700 ft; and 5 ex 1 *R. edwardsi*, 4000 ft. This species is closely related to *W. oudemansi*, but restricted in habitat. Pallid chiggers in Ecological Group II.

Walchiella lacunosa (Gater, 1932)

149 ex 4 *R. edwardsi*, 3500 to 4000 ft. This is a sub-montane species commonly parasitizing *R. edwardsi*. Yellow chiggers in Ecological Group II.

Walchiella oudemansi (Walch, 1923)

2 ex 1 *E. gymmurus*, 700 ft; 127 ex 6 *R. sabanus*, 700 to 800 ft; 101 ex 2 *R. muelleri*, 700 to 800 ft; 5 ex 1 *R. boversi*, 800 ft; 13 ex 1 *Sundasciurus lowii*, 800 ft; 2 ex 2 *Callosciurus notatus*, 1000 ft; 26 ex 2 *Lariscus insignis*, 700 to 800 ft; 122 ex 1

*A new species of *Torotrombicula* was described from the same species of host in the Cameron Highlands (Nadchatram, 1967). The species, *Tori. uphami*, was found with *Tori. densipiliata* and *Odon. audyi*. While the two latter species have been found both on migratory and resident birds in Malaya, it would seem that the host of *T. uphami* was a recent arrival in Malaya.

Rhinosciurus laticaudatus, 700 ft; and 2 ex 1 *Hemigalus derbyanus*, 900 ft. This common species was found on a variety of ground-dwelling and, to a lesser degree, tree-dwelling small mammals, and has been found on man in Indonesia. The range of habitat is also broad. Ground-hole chiggers are pallid and ground-surface dwellers orange. Ecological Groups I, II, and III.

***Ascoschoengastia audyi* (Womersley, 1952)**

7 ex 1 *P. lowii*, 1700 ft; 5 ex 2 *R. sabanus*, 700 ft; 42 ex 2 *C. nigrovittatus*, 700 ft; 164 ex 5 *C. notatus*, 700 to 1000 ft; and 10 ex 1 *Iomys horsfieldi*, 800 ft. *R. sabanus* is an unusual host; this chigger is a common arboreal species frequently associated with tree squirrel in forests and plantations. Traub et al, (1950) recovered *Rickettsia tsutsugamushi* from *A. audyi*. Pink to orange. Ecological Group III.

***Ascoschoengastia ctenacarus* Domrow, 1962**

3 ex 1 *I. horsfieldii*, 800 ft. This is an uncommon arboreal species. Orange chiggers. Ecological Group III.

***Ascoschoengastia indica* (Hirst, 1915)**

2 ex 1 *R. edwardsi*, 4000 ft; and 2 ex 1 *C. nigrovittatus*, 800 ft. The rarity of this species in Gunong Benom is expected since it is essentially associated with commensal rats, especially the house rat *Rattus (r.) diardii*. It has an extensive geographical, ecological and host distribution. Gispon (1950) recovered the infective agent of murine fleaborne typhus, *Rickettsia moosevi*, from *A. indica* collected from *R. (r.) diardii* and *R. norvegicus* in Indonesia. White to orange chiggers. Ecological Groups I, II and III.

***Ascoschoengastia roluis* (Traub & Audy, 1954)**

4 ex 1 *Ptilocercus lowii*, 1700 ft; 4 ex 1 *Iomys horsfieldii*, 800 ft. This is an uncommon species. White chiggers. Ecological Group III.

***Helenicula mutabilis* (Gater, 1932)**

2 ex 1 *Rattus sabanus*, 800 ft; 3 ex 1 *R. muelleri*, 800 ft; 6 ex *R. bowersi*, 800 ft; and 20 ex 1 *Hemigalus derbyanus*, 900 ft. This species is essentially a ground-surface dweller most frequently found in grassland and is therefore presumed to be a secondary parasite of these forest rats. Orange chiggers. Ecological Group I.

***Doloisia brachypus* (Audy & Nadchatram, 1957)**

2 ex 1 *Sundasciurus lowii*, 800 ft. This squirrel is an unusual host for the species. The genus *Doloisia* represented by 10 species in Malaya, is exclusively intranasal and previously known only from murids. Pallid chiggers. Ecological Group II.

Gahrliepia (Gahrliepia) cetrata Gater, 1932

2 ex 2 *R. sabanus*, 900 to 950 ft; 1 ex *R. edwardsi*, 4000 ft. An uncommon, pallid chigger. Ecological Group II.

Gahrliepia (Gahrliepia) fletcheri Gater, 1932

4 ex 1 *R. sabanus*, 800 ft. This is one of the commonest species of *Gahrliepia* in the Malayan forests. Its replacement by *G. neteralla*, a very closely related species, in Gunong Benom is interesting. Pallid chiggers. Ecological Group II.

Gahrliepia (Gahrliepia) insigne Womersley, 1952

A single specimen ex *R. sabanus*, 700 ft. Yellow chiggers. Ecological Group II.

Gahrliepia (Gahrliepia) neteralla Traub & Morrow, 1955

1 ex *Ptilocercus lowii*, 1700 ft; and 644 ex 23 *Rattus sabanus*, 700 to 1500 ft. This is the second commonest chigger species taken on Gunong Benom. The distribution of this species is spotty, with localized dense populations in some areas, few or none in other. Our records show a similar dense infestation pattern in the Ampang Forest Reserve, Selangor, where the common host was also *R. sabanus*. In most other areas investigated, although *R. sabanus* was caught frequently, *G. neteralla* was either absent or occurred in fewer numbers. Pallid chiggers. Ecological Group II.

Gahrliepia (Gahrliepia) picta Traub & Morrow, 1955

1 ex *R. sabanus*, 950 ft; 1 ex *R. bowersi*, 800 ft. This is a rare species. Unfed larvae were recovered from ground-burrows elsewhere. Pallid chiggers. Ecological Group II.

Gahrliepia (Gahrliepia) rutila Gater, 1932

9 ex 2 *R. sabanus*, 700 to 1000 ft; 4 ex 1 *R. edwardsi*, 4000 ft. This is a rare species; unfed larvae are known from ground-burrows. Pallid chiggers. Ecological Group II.

Gahrliepia (Gahrliepia) sp.

9 ex 6 *R. sabanus*, 700 to 1000 ft. This indeterminate species is intermediate between *G. fletcheri* and *G. neteralla*. Pallid chiggers. Ecological Group II.

Gahrliepia (Schoengastiella) argalea Traub & Morrow, 1957

A single unfed specimen recovered from ground-burrow in the bank of the old logging track, 900 ft. The favoured host of this species is *R. sabanus*. Pallid chiggers. Ecological Group II.

Gahrliepia (Walchia) alpestris Traub & Morrow, 1957

A single specimen ex *Ptilocercus lowii*, 1700 ft. A rare species. Pallid chiggers. Ecological Group II.

Gahrliepia (Walchia) disparunguis pingue (Gater, 1932)

66 ex 2 *Rattus whiteheadi*, 800 ft; 36 ex 1 *Rattus inas*, 3600 ft; and 13 ex 1 *Rattus tiomanicus*, 3600 ft. *R. whiteheadi* is the favoured host of this species. Pallid chiggers. Ecological Group II.

Gahrliepia (Walchia) rustica Gater, 1932

14 ex 2 *R. sabanus*, 800 ft; 156 ex 14 ground-burrows in bank of forest path. Pallid chiggers. Ecological Group II.

Gahrliepia (Walchia) turmalis Gater, 1932

2 ex 1 *Echinosorex gymnurus*, 700 ft; 831 ex 20 *Rattus sabanus*, 700 to 1500 ft; 46 ex 1 *R. bowersi*, 800 ft; 6 ex 1 *R. edwardsi*, 4000 ft; and 5 ex 1 ground-burrow in bank of forest path. This species is close to *G. rustica*, and the commonest species taken in Gunong Benom. Pallid chiggers. Ecological Group II.

2. Hosts

List of numbers infested (number examined in parentheses) and species of chiggers.

REPTILES

Draco spp. 8 infested (of 16): *Eltonella tweediei*, *Neoschoengastia riversi*

BIRDS

Pitta caerulea 1 (1): *Odontacarus audyi*, *Toritrombicula densipiliata*

Pitta sordida 1 (1): *Leptotrombidium deliense*, *Tori. densipiliata*, *Siseca rara*,
Neoschoengastia solitus

Napothera macrodactyla 1 (1): *L. bodense*

Philentoma velata 1 (1): *Tori. densipiliata*

MAMMALS

Echinosorex gymnurus 1 (1): *L. bodense*, *Walchiella impar*, *W. oudemansi*,

Gahrliepia (Walchia) turmalis

Rhinolophus stheno 16 (54): *Myotrombicula medwayi*, *Chiroptella sandoshami*

Rhinolophus affinis 1 (21): *C. sandoshami*

Rhinolophus macrotis 1 (1): *C. sandoshami*

Tupaia minor 1 (1): *W. oudemansi*

Ptilocercus lowii 1 (1): *Ascoschoengastia audyi*, *A. rohuus*, *W. impar*, *G. (W.) alpestris*

- Rattus sabanus* 24 (33): *L. deliense*, *L. bodense*, *A. audyi*, *W. oudemansi*, *Helenicula mutabilis*, *G. (W.) rustica*, *G. (W.) turmalis*, *G. (G.) cetrata*, *G. (G.) insigne*, *G. (G.) neteralla*, *G. (G.) picta*, *G. (G.) rutila*, *G. (G.) fletcheri*, *G. (G.) sp.*
- Rattus muelleri* 2 (3): *L. deliense*, *L. bodense*, *W. oudemansi*, *H. mutabilis*
- Rattus whiteheadi* 2 (5): *G. (W.) disparunguis pingue*
- Rattus bowersii* 2 (2): *L. deliense*, *W. oudemansi*, *H. mutabilis*, *G. (W.) turmalis*, *G. (G.) picta*
- Rattus cremoriventer* 1 (2): *L. bodense*
- Rattus edwardsi* 4 (4): *L. deliense*, *L. bodense*, *L. sylvestre*, *A. indica*, *W. impar*, *W. oudemansi*, *G. (W.) turmalis*, *G. (G.) cetrata*, *G. (G.) rutila*
- Rattus inas* 1 (2): *G. (W.) disparunguis pingue*
- Sundasciurus lowii* 2 (4): *W. oudemansi*, *Doloisia brachypus*
- Callosciurus nigrovittatus* 2 (6): *A. audyi*, *A. indica*
- Callosciurus notatus* 5 (5): *A. audyi*, *W. oudemansi*
- Callosciurus caniceps* 1 (1): *Siscea rara*
- Lariscus insignis* 2 (3): *W. oudemansi*
- Rhinosciurus laticaudatus* 1 (3): *W. oudemansi*
- Iomys horsfieldii* 1 (3): *A. audyi*, *A. ctenacarus*, *A. indica*
- Hemigalus derbyanus* 1 (1): *W. oudemansi*, *H. mutabilis*
- Tragulus javanicus* 1 (1): *L. bodense*
- Heterometrus longimanus* 1 (1): *Audyana thompsoni*

3. Unattached chiggers

Aside from the examination of animals for chiggers and other ectoparasites, ground-holes, shallow cavities in the ground, depression under over-hanging roots, and leaf-litter on the forest floor were examined with the aid of strips or plates of black 'bakelite'. Chiggers were found only in tunnels which are presumed to be rat-burrows. Of approximately 40 holes sampled 16 were positive for chiggers, which were represented by the following four species: *Leptotrombidium gentryi*, *L. kundini*, *Gahwiepia (W.) rustica* and *G. (W.) turmalis*. *G. rustica* was the commonest species of hole chiggers. One of the holes found positive for chiggers also yielded several larvae of the common rodent tick, *Ixodes granulatus*.

DISCUSSION

With 35 species, the chigger fauna recorded from Gunong Benom is considered rich considering the short duration of the survey. While this collection fills a gap in our knowledge of the overall distributional pattern of Malayan chiggers, the material reported above is typical of other forests of the Malayan mainland. The survey supports the ecological findings of the author, and in particular the ecological grouping of Malayan species (Nadchatram, 1970). The forest is the reservoir of parasites and, possibly, infections. The constant environment that the forest provides, plus the microclimatic conditions of the subterranean nests of the host animals—ideal for the existence of forest species—, serve to explain why approximately 80 per cent of the 146 Malayan species are endemic in forest. The ease with

which the newly hatched larvae of cavernicolous species attach to the host animal (by dropping from the roof of the burrow) is perhaps one of the major contributing factors for the vigorous propagation of the trombiculid fauna.

Several species, i.e. 17 percent of 146 species, proven to be adaptable to fluctuating environmental conditions, are believed to have evolved from a sylvatic origin and perhaps a cavernicolous habitat. These species are found on ground-surface, stems of grass, and leaf-litter on forest floor, and include all species which have been indicted with causing scrub-typhus and scrub itch. Because of the habitats they occupy, these are the species which have the best opportunities of coming into contact with man (Ecological Group I). The writer's observations support the well-known belief that scrub typhus is a man-made malady. When the forest environment is disturbed by man, artificial environments are created which disrupt the natural conditions in which chiggers occur. Some sylvatic species are unable to tolerate the artificial conditions and perish; some that have the opportunity withdraw to their natural retreats, while a few others become adapted to the new situation created by deforestation and flourish. In this new ecological situation other groups of hosts are also encouraged, i.e. ground birds, reptiles, and mammals. Some chigger species, including *Leptotrombidium deliense* the well-known vector of scrub typhus, are readily dispersed by birds and rats. *Rattus tiomanicus jalorensis*, a wide-ranging rat, is a common host of *L. deliense* and most numerous in oil-palm, coconut, and rubber plantations. It also has been collected in sub-montane forest and the fringes of primary and secondary forests.

The 35 Gunong Benom species are placed in six ecological groups. The eight species which fall in Ecological Group I were all collected around the base camp between 700 and 900 ft, where the vegetation is mostly secondary as a result of previous logging.

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